

A MEGASTROBILUS BELONGING TO THE ARAUCARIACEAE FROM THE RAJMAHAL HILLS, BIHAR, INDIA

M. N. BOSE & K. P. JAIN

Birbal Sahni Institute of Palaeobotany, Lucknow

ABSTRACT

The present communication is concerned with an incomplete megastrobilus belonging to the Araucariaceae. The specimen is a portion of a cone having the central axis with several, compact, spirally arranged non-ligulate cone-scales; mostly with a single, completely embedded seed, but very few (here seen in only two cone-scales) in their early stages of development possess two unequal groups of nucellar cells.

INTRODUCTION

OUR knowledge of the Indian Mesozoic petrified cones belonging to the Araucariaceae is very meagre. Bose & Hsü (1953) described a few petrified male cones from Amarjola, Rajmahal Hills, Bihar, which they thought probably the male cones of *Brachyphyllum*. Mittre (1954) reported a petrified megastrobilus from Bindrabun, Rajmahal Hills as *Araucarites bindrabunensis*. From Nipania, also in the Rajmahal Hills, a detached female cone-scale was described by Singh (1956) as *Araucarites nipaniensis*.

The present petrified megastrobilus was collected by one of us (BOSE) in 1957 from Amarjola, Rajmahal Hills, from the same locality from where Bose and Hsü (1953) described the male cones belonging to *Brachyphyllum*. The megastrobilus is incomplete, representing probably only the middle region, both apical and basal regions are missing.

DESCRIPTION

Pls. 1-2, Figs. 1-13

Incomplete, compact megastrobilus, 2×3.1 cm. in size. Cone-axis 1.1 cm. in diameter, angular in cross section, internal structure not preserved. Cone-scales many 1.2×0.7 cm. in size; spirally arranged, woody, non-ligulate, triangular, narrow towards axis, gradually broadening towards distal end, attaining a broad, solid rhomboidal structure with probably a laminar tip (in the specimen represented only by rhomboidal cars or projections). Lateral sides broadly

expanded to form thin, prominent, membranous wings. Wings forming an imbricate and interlocking position between the adaxial and abaxial halves of the two cone-scales, giving a compact nature to the cone. Surface cells elongated, irregularly packed. Cross section of cone-scales shows the uppermost barrel-shaped epidermal cells, 2-3 celled deep sclerenchymatous cells, followed by longer than broad well developed palisade cells with intercellular spaces, less developed towards proximal end. The inner space filled with parenchymatous spongy cells, separated from palisade cells by 2-3 celled deep, elongated cells. Details of vascular traces not known. Seeds only one in each cone-scale at maturity, small, totally embedded, somewhat oval, about 5×1 mm. in size, medianly placed near the base, inverted, narrow towards the cone-axis, broader distally. Out of 30 or more cone-scales only 2 or 3 fertilized and in a few only developing ovules seen. In surface longitudinal section two cone-scales show in each of them two developing ovules in the form of two unequal groups of longer than broad nucellar cells, with a separating layer of thin-walled cells. In these nucellar cells without a gametophyte there seem to have a developing undifferentiated integument around them. Seed coat thick and stony, other details not preserved.

Locality — Amarjola, Rajmahal Hills, Bihar.

Horizon — Rajmahal Series.

Type Specimen — B.S.I.P. No. 28081.

COMPARISON AND DISCUSSION

The compact nature of cone, spirally arranged megasporophylls without a ligule but with characteristically developed wings on the lateral sides and a medianly placed, single, completely embedded seed in each cone-scale, are the features indicating its relationship with the family Araucariaceae. The two living genera *Araucaria* Jussieu and *Agathis* Salisbury representing the family are quite distinct from each other as far as

the female fructifications are concerned. The present specimen shows closer affinities with *Araucaria* than *Agathis*. In the absence of ligule it resembles the genus *Agathis* and also *Araucaria araucana* and *A. angustifolia* both belonging to the *Colymbea* Sect. of the genus *Araucaria*, where the ligule is obscure (WILDE & EAMES, 1952). Otherwise, in its other characters especially the broad wings and the two ovular condition in two of the cone-scales bring it nearer to the *Eutecta* Sect.: such as *Araucaria montana* and *A. rulei* and *A. bidwilli* of *Bunya* Sect. (MITRA, 1927; FLORIN, 1951 & WILDE & EAMES, 1948, 1955).

Among the fossil megastrobili belonging to *Araucariaceae* the present specimen may be compared with *Araucaria mirabilis* (Speg.) Calder (1953), *Araucarites bindrabunensis* Mittre (1954) and *Mohgaostrobus sahnii* Prakash (1961). *A. mirabilis* resembles the *Amarjola* specimen in having a single completely embedded seed in each cone-scale but differs mainly in having prominent ligule and in the presence of sclereids and mucilage ducts in the pith. *A. bindrabunensis* is also single seeded but differs in having ligule. Also two ovular condition is not known in

A. bindrabunensis. *M. sahnii* has no ligule and in this two seeds are embedded, but differs from our megastrobilus in having two mature seeds per cone-scale. In the present fossil the two ovulate condition has only been seen in the early stages of development where they are represented in the form of two unequal groups of nucellar cells out of which only one survives till maturity, indicating the abortive nature of the smaller one. The isolated petrified cone-scale *Araucarites nipaniensis* Singh (1956) differs from the present cone in having a comparatively small seed placed on a very prominently winged cone-scale.

A detached mature cone-scale with a single embedded seed of the present megastrobilus may be compared with some of the isolated cone-scales of *Araucarites* Presl. having no ligule. But the two ovulate condition represented by two groups of nucellar cells in early stages of development is not known in *Araucarites*. If we consider only the mature cone-scales, then the present megastrobilus can be placed under *Araucarites* Presl. But as the specimen is too incomplete we have for the present, thought best not to place it under any genus.

REFERENCES

- BOSE, M. N. & HSÜ, J. (1953). On some coniferous cones, probably of *Brachyphyllum*, from the Jurassic of the Rajmahal Hills, Bihar, India. *Proc. nat. Inst. Sci.*, **19** (2): 203-209.
- CALDER, M. G. (1953). A coniferous petrified forest in Patagonia. *Bull. Brit. Mus. (nat. Hist.)*, **2** (2): 99-138.
- FLORIN, R. (1951). Evolution in *Cordaites* and conifers. *Acta Hort. berg.*, **15** (11): 285-388.
- MITRA, A. K. (1927). On the occurrence of two ovules on araucarian cone-scales. *Ann. Bot.*, **41**: 461-471.
- MITTRE, V. (1954). *Araucarites bindrabunensis* sp. nov., a petrified megastrobilus from the Jurassic of Rajmahal hills, Bihar. *Palaebotanist*, **3**: 103-108.
- PRAKASH, U. (1962). Further observations on a petrified ovuliferous cone (*Mohgaostrobus sahnii* Gen. et sp. nov.) from Mohgaon Cherts in the Deccan. *Ibid.*, **10** (1): 1-5.
- SINGH, G. (1956). *Araucarites nipaniensis* sp. nov.—a female Araucarian cone-scale from the Rajmahal Series. *Ibid.*, **5** (2): 64-65.
- WILDE, M. H. & EAMES, A. J. (1948). The ovule and seed of *Araucaria bidwilli* with discussion of the taxonomy of the genus. I Morphology. *Ann. Bot.*, N.S. **12** (47): 311-326.
- Idem (1952). The ovule and 'seed' of *Araucaria bidwilli* with discussion of the Taxonomy of the genus II Taxonomy. *Ibid.*, **16** (1): 27-47.
- Idem (1955). The ovule and 'seed' of *Araucaria bidwillii* with discussion of the taxonomy of the genus III. Anatomy of multi-ovulate cone scales. *Ibid.*, **19** (75): 343-349.

EXPLANATION OF PLATES

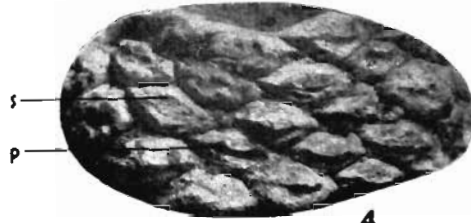
PLATE 1

1. Megastrobilus. No. 28081. $\times 1$.
2. Same viewed from above showing the central axis (a) and the cone-scales (cs.). $\times 1$.

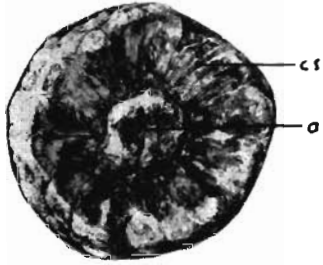
3. The above magnified. $\times 2-5$.
4. Tangential view, showing rhomboidal scars (s) and projections (p). $\times 2$.
5. Tangential section, showing the broad wings (w) in interlocking position. No. 28081-3. $\times 8$.



1



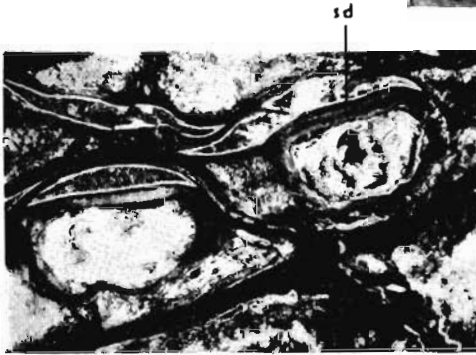
4



2



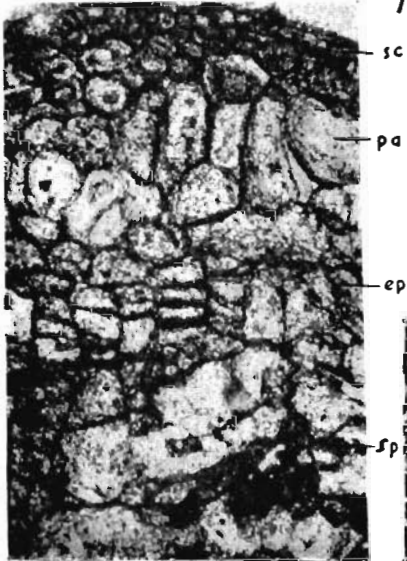
3



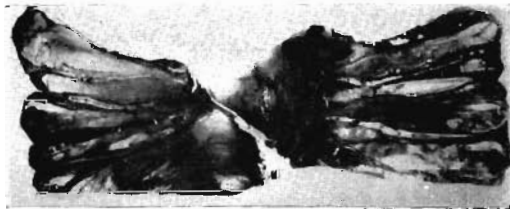
7



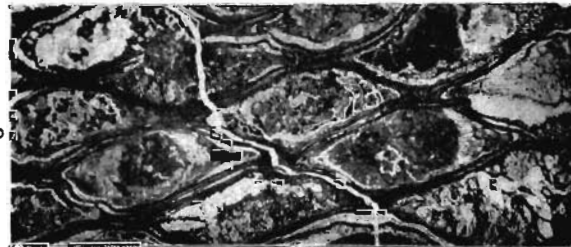
5



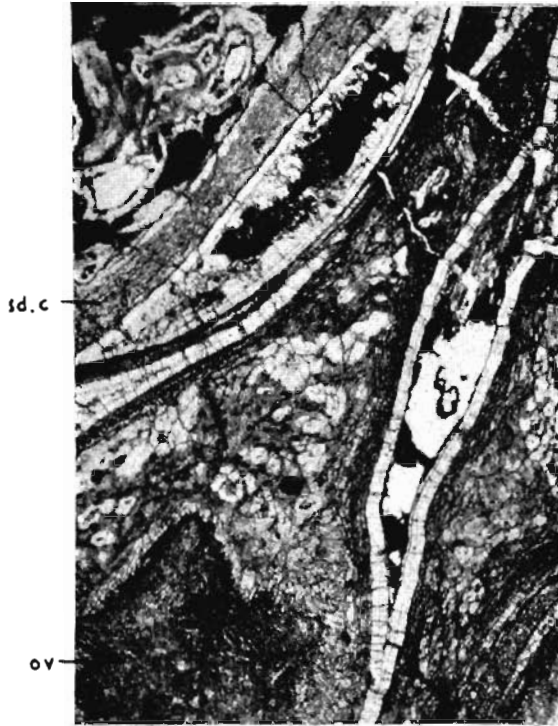
8



9



6



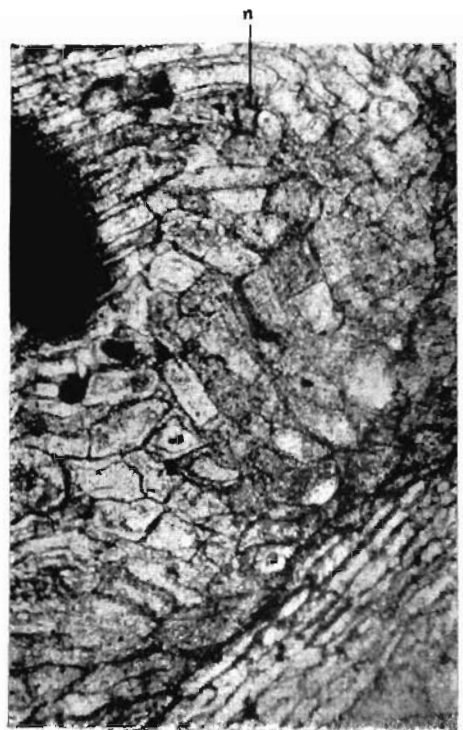
10



11



12



13

6. Tangential section, showing the rhomboidal cone-scales. No. 28081-3. $\times 4$.

7. Tangential section, showing single seeded condition in each cone-scale. No. 28081-4. $\times 8$. Sd — seed.

8. The above magnified, showing anatomical features. Sc.— sclerenchymatous layer, pa.— palisade cells, ep.— epidermis like cells and sp.— spongy cells. No. 28081-4. $\times 120$.

9. Radial longitudinal section of the cone. No. 28081-2. $\times 2$.

PLATE 2

10. A part of tangential section, showing developing ovule and stony seed coat. Sd.C.—Seed coat, ov.— ovule. No. 28081-4. $\times 25$.

11. A part of radial longitudinal section, showing the developing ovule. No. 28081-1. $\times 25$.

12. A portion in surface longitudinal section, showing two unequal groups of nucellar cells. No. 28081-6. $\times 120$.

13. The above, showing the nucellar cells (n). No. 28081-1. $\times 120$.